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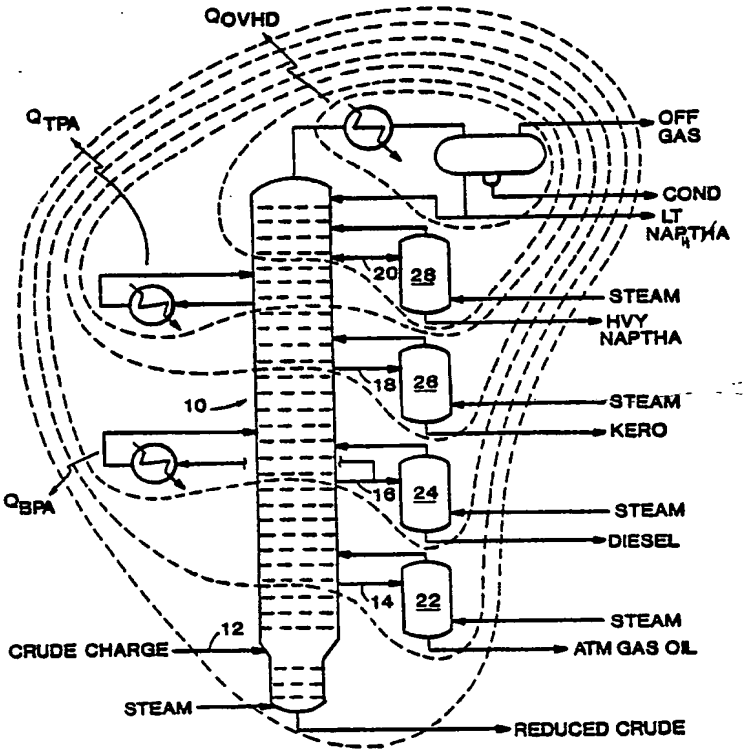
(54) Title: DISTILLATION CUT POINT CONTROL

(57) Abstract

Control of crude oil distillation columns. In particular, properties of the liquid in the bottom tray of a side stream stripping unit (22) associated with the crude distillation column (10) are monitored in order to control product drawn rates thereby maintaining desired product cut points. Preferably, partial pressures and initial boiling points of the equilibrium flash vaporization curve ("IBP/EFV") are monitored in this control Scheme.



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DISTILLATION CUT POINT CONTROL

Field of the Invention

This invention relates to removal of cuts from mixtures of liquids, and more particularly to cut point control in petroleum crude towers.

Background of the Invention

It has been known to correlate side draw temperatures with cut points through simultaneous monitoring of numerous tower parameters (e.g., Nelson, "Petroleum Refinery Engineering", McGraw-Hill, Fourth Ed. 1958, 473 ff).

Summary of the Invention

I have discovered that the cut point between any heavier cut to be withdrawn and lighter material may be controlled based on parameters around simply the bottom tray of a stripper for said heavier cut.

In particular, I have discovered that said cut point may be controlled through use of a characteristic of the liquid in said bottom tray.

In a preferred embodiment, said characteristic is the partial pressure of said liquid.

In a further preferred embodiment, said characteristic is the initial boiling point of the equilibrium flash vaporization curve ("IBP/EFV") of said liquid at atmospheric pressure.

By "cut point", I mean that temperature (in °F) on a true boiling point ("TBP") curve (i.e., a batch process curve of percent of mixture--e.g., crude oil--removed in a heavily refluxed tower versus temperature reached to achieve that removal at which a predetermined degree of separation is reached).

Preferred Embodiment

I turn now to a description of the drawings, and of a preferred embodiment of the invention.

Drawings

Fig. 1 is a diagrammatic view with respect to practice of the method.

Fig. 2 is a pair of curves intersecting to give a cut point.

Steps

A crude tower of conventional arrangement, as shown in Fig. 1, and indicated generally at 10, and containing about fifty plates, was continuously supplied with heated crude oil through line 12. Emerging from tower 10 in order up its height were draw lines 14 (for atmospheric gas oil), 16 (for diesel oil), 18 (for kerosene), and 20 (for heavy naphtha). Said draw lines fed respectively into strippers 22, 24, 26, and 28 above the top plate of each thereof (each stripper having about six plates).

It was decided in advance that composition ranges desired to be manufactured would call for cut points between the atmospheric gas oil and diesel oil of 704°, between diesel oil and kerosene of 492°, and between kerosene and heavy naphtha of 322°. My invention was used to maintain and control at these predetermined cut points (all temperatures mentioned in this document Farenheit) each of the three.

The invention may be explained in particular detail with respect to the cut point between diesel oil and kerosene.

At startup, temperature in the draw tray from

which draw line 16 emerged was monitored until about that expected to be associated with the desired cup point, about 515°.

My control method was then used to regulate actual cut point.

The following measurements were taken, then, each minute:

(1) Steam flow to stripper 24 (lbs./hr.)

(2) Diesel oil flow from bottom of stripper 24 (barrels/day)

(3) Temperature in diesel oil draw line 16

(4) Temperature of diesel oil flowing from bottom of stripper 24

(5) Pressure in stripper 24 (treated as that at draw tray from which draw line 16 emerges, and determined by interpolating between bottom and top pressures of tower 10)

(6) Temperature of steam into stripper 24

(7) Pressure of steam into stripper 24.

Using these seven measurements, together with constants from laboratory data to give specific heat, partial pressure of diesel oil ("liquid") in the vapor above the bottom plate of stripper 24 is obtained; this is then used to determine atmospheric pressure IBP/EFV of the diesel oil. In making this determination, constants are desirably used which from most recent (usually daily) laboratory data update the apex of the two-phase region triangle defined by plotting EFV's for various vaporization percentages as shown in Fig. 3B3.1 of API Technical Data Book (August, 1963), pressure versus temperature graphs for each percentage mixture being a straight line. (Since partial

pressure of the diesel oil and the temperature of the diesel oil on the bottom tray of stripper 24 define one point on the initial boiling point--i.e., 100% liquid, "IBP"--line and the apex the other, the atmospheric IBP/EFV may be easily picked off.)

Once daily the laboratory supplied an ASTM curve of temperature versus percent vaporized, for both the diesel oil and the kerosene. Using conventional conversions, these permitted establishment of true boiling point curves for each. Using these, plotted over widths reflecting their relative volumes (barrels/day), and with kerosene curve flipped, all as shown in Fig. 2, an intersection results at a temperature which is the cut point.

The difference between this temperature and the IBP/EFV temperature gives a correction factor that may be used with the IBP/EFV temperature to provide the running (minute by minute) cut point.

If the measured cut point is not exactly that desired, the flow rates in draw lines 16 and 18 are appropriately varied, in equal but opposite amounts.

In the same manner, the cut point between atmospheric gas oil and diesel oil was controlled using stripper 22 as the focus of control in the same way as was stripper 24 in the control above described, and, in the same way, the cut point between kerosene and heavy naphtha was controlled using stripper 26 as the focus of control. The cut point between heavy naphtha and light naphtha was controlled by prior art methods, although the method of my invention could of course have been used.

Claims

Other embodiments of the invention within the

following claims will occur to those skilled in the art.

I claim:

1. The method of controlling the content of a draw from a distillation column which comprises monitoring a characteristic of contents of a stripper downstream of a draw.

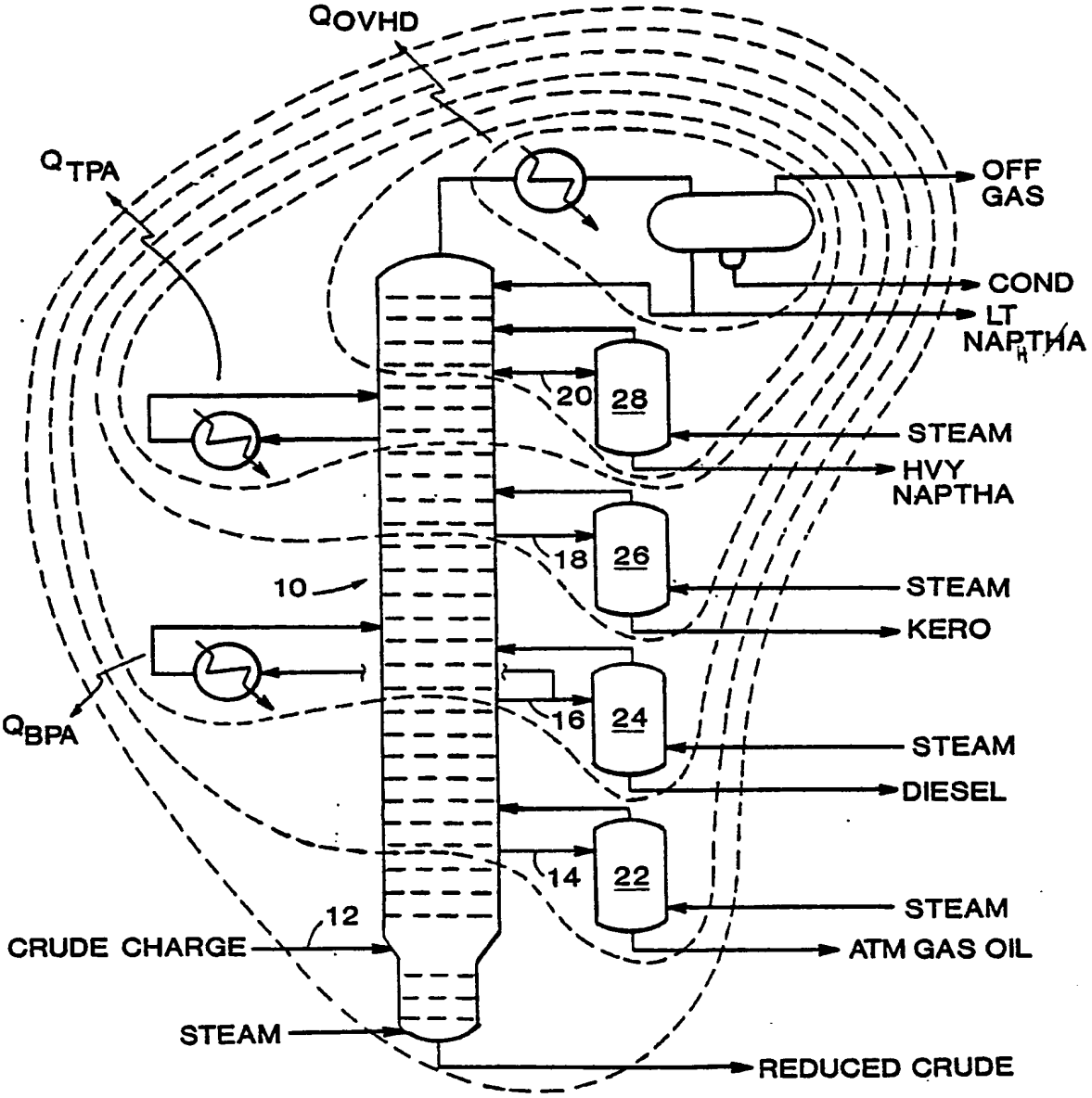
2. The method of claim 1 in which said contents is that being withdrawn from said stripper.

3. The method of claim 1 in which said characteristic is the partial pressure of liquid on the bottom plate of said stripper.

4. The method of claim 3 in which another said characteristic is the IBP/EFV of said liquid at atmospheric pressure.

5. The method of claim 4 in which said liquid is a crude oil cut.

6. The method of claim 3 in which said liquid is a crude oil cut.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STEAM
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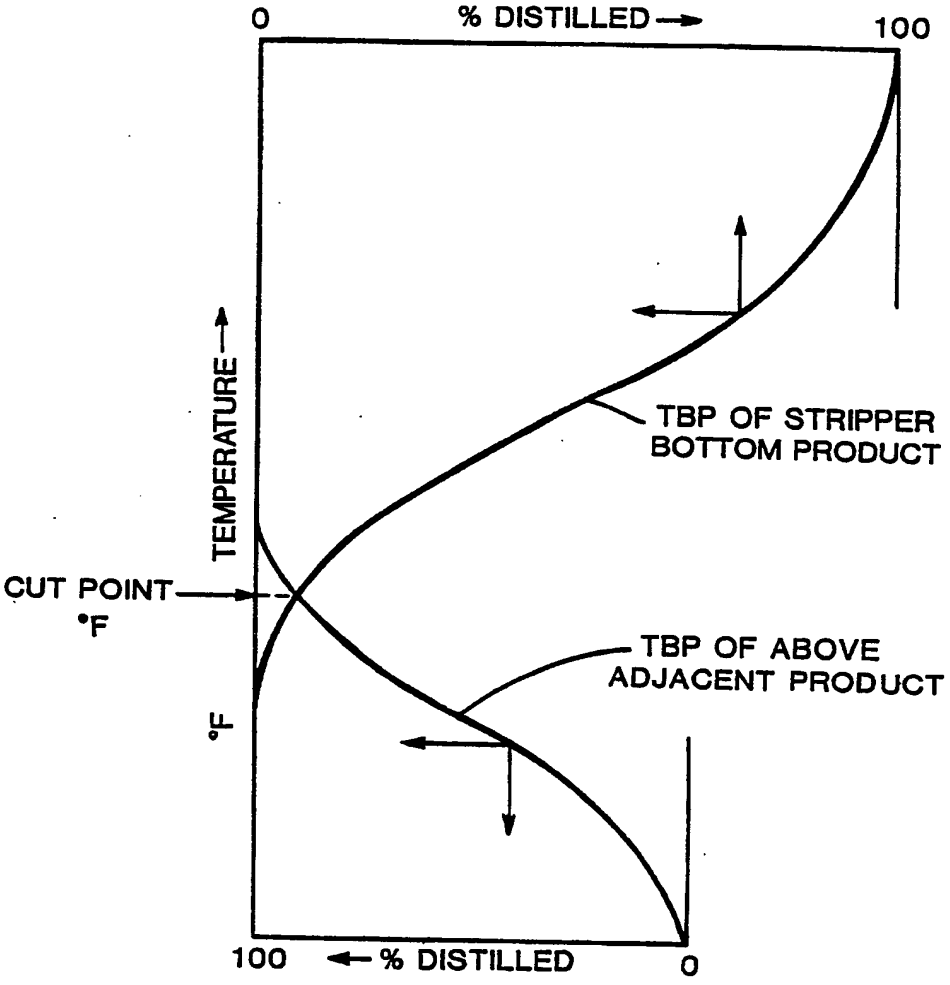
FIG. 1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TEMPERATURE
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TBP OF STRIPPER BOTTOM PRODUCT
CUT POINT
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°F
100
% DISTILLED
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FIG. 2

INTERNATIONAL SEARCH REPORT

International Application No PCT/US86/00881

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [3]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int. Cl. [4] C10G 7/12;B01D 3/14
U.S. Cl. 208/347;208/355;208/Dig. 1

II. FIELDS SEARCHED

Minimum Documentation Searched [4]

Classification System	Classification Symbols
U.S.	208/347,354,355,364,Dig. 1 203/1.2.3

Documentation Searched other than Minimum Documentation to the Extent that such Documents are included in the Fields Searched [5]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [14]

Category *	Citation of Document, [16] with indication, where appropriate, of the relevant passages [17]	Relevant to Claim No. [18]
X Y	US, A, 3,365,386, (Van Pool) 23 January 1968, see especially column 3, lines 22-27.	1,2,5,6 3,4
Y	Edminster, "Applied Hydrocarbon Thermodynamics" Published 1981, Gulf Publishing Co, USA, see pages 116-132.	3,4
A	US, A, 3,320,158, (Potts) 16 May 1967.	

* Special categories of cited documents: [15]

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IV. CERTIFICATION

Date of the Actual Completion of the International Search [2]	Date of Mailing of this International Search Report [2]
11 July 1986	24 JUL 1986
International Searching Authority [1]	**Signature of Authorized Officer [20]**
ISA/US	Glenn A. Caldarola

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